

PATENT ABSTRACTS OF JAPAN

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(71)Applicant : NEC CORP

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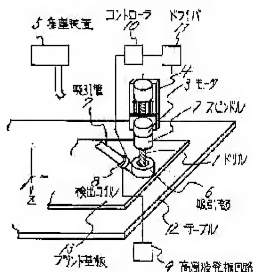
(72)Inventor : FUKUSHIMA MIKI

(54) COUNTER BORING DEVICE

(57)Abstract:

PURPOSE: To provide an automatic control means for the depth of the counterbore of an identification mark provided on each layer used for position identification in boring a reference hole through a photomultilayer printed board.

CONSTITUTION: Chips of a printed board 13 are allowed to pass through a suction tube 7 in such a manner that chips from a copper foil portion and chips from an insulating portion are alternately fed. A detection coil 8 generates a high frequency magnetic field, detecting passage of metals. Alternatively, chips of copper foil are detected by a semiconductor laser and a light receiving element both of which are provided to a suction opening 6. The number of times of detection of the copper foil by the detection coil 8 (i.e., the number of layers) is counted, whereby control of the depth of a counter bore, which has conventionally been done by hands, can be automated.



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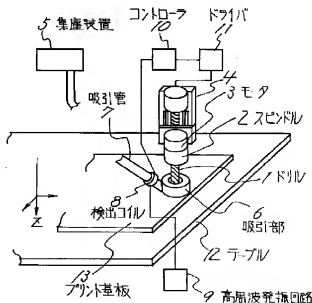
(74)代理人 弁理士 内原 晋

(54)【発明の名称】 座繰り装置

(57)【要約】

【目的】 光多層プリント基盤の基準穴あけ時の位置確認に用いる各層にある認識マークの座グリ深さの自動制御手段を揭示する。

【構成】 吸引管 7 を通過するプリント基板の切屑は銅箔部からのものと絶縁部からのものとを繰り返す。検出コイル 8 は高周波磁界を生じており金属が通過したことを検知する。または、吸引口部に設けた半導体レーザと受光素子で銅箔の切屑を検出する。検出コイル 8 で検出する銅箔の回数 (すなわち層数) をカウントしていくことにより、従来人手に頼っていた座グリ深さの制御を自動化できる。



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【特許請求の範囲】

【請求項1】 対象物に座繰りを行うドリルと、このドリルを前記対象物の表面に対しほぼ垂直に移動させるZステージと、前記対象物の表面の前記ドリルの周囲に設けた吸引口部に吸引管により接続され座繰り時の切屑を吸引する集塵装置と、前記吸引管上に設置され高周波電流が供給される検出コイルと、この検出コイルが出力する電圧振幅が閾値を越え変化するのが設定回数に達するまで前記Zステージにより前記ドリルを前記試操物に向けて前進させる制御部とを含むことを特徴とする座繰り装置。

【請求項2】 対象物に座繰りを行うドリルと、このドリルを前記対象物の表面に対しほぼ垂直に移動させるZステージと、前記対象物の表面の前記ドリルの周囲に設けた吸引口部に吸引管により接続され座繰り時の切屑を吸引する集塵装置と、前記吸引部に設けられた発光素子および受光素子と、前記受光素子が受ける前記発光素子からの光が前記吸引口部に吸引される切屑の材質の相異により閾値を越えて変化するのが設定回数に達するまで前記Zステージにより前記ドリルを前記対象物に向けて前進させる制御部とを含むことを特徴とする座繰り装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、異なる材質が積層された対象物に座繰りを行う座繰り装置に関し、特に多層プリント基板の位置決めマークの座繰りに用いる座繰り装置に関する。

【0002】

【従来の技術】多層プリント基板は、信号層と電源層との電気的接続や部品実装のための穴あけを行う必要がある。近年の高多層・高密度実装のプリント基板では信号層の回路幅が100 μ m程度であり、このプリント基板への穴あけはその位置精度を $\pm 30 \sim 50 \mu$ m程度にする必要がある。このため穴あけを行うときは、穴あけ装置に対しプリント基板を高精度に位置決めして固定する。この固定はプリント基板上に位置決め用のピンをあらかじめ打ち込み、このピンを利用するのが一般的である。このピンはプリント基板上の位置決めマーク上に打ちこまれる。

【0003】ここで多層プリント基板の場合の内層の位置決めマークを認識するために座繰りが必要となる。図4(a)および(b)それぞれに多層プリント基板断面図および平面図を示す。プリント基板は大別して銅箔部20、プリpreg部21、絶縁部22(ポリイミド)からなり各層の銅箔部20に位置決めマーク22を有する。多層プリント基板では、認識したい位置決めマークのある層まで層数分の座繰りを行う。ただし電源層等で高精度の穴あけを必要としない層に関しては省くことも多い。

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【0004】また一方、高多層プリント基板では内層のうち一層あたりの厚みが50 \sim 100 μ m程度、銅箔厚みが18 \sim 35 μ m程度と非常に薄くなっており、この各層に座繰りを入れることは10 μ m程度の座繰り深さ方向の位置決め精度が必要となる。ドリルの座繰り方向の位置決めをサーボモータ等で制御することにより座繰り深さ方向の位置決め精度内にコントロールすることも可能であるが、プリント基板そのものに数 μ m \sim 数mmのそりが生じているために、ドリルのみの位置精度を高くしても意味がない。そこで従来は、熟練した作業者の目視確認を含めた作業により多層プリント基板の位置決めマークの座繰りを行っていた。

【0005】

【発明が解決しようとする課題】プリント基板の座繰りは高多層になればなるほど数も多くなるため、従来の人手作業では作業工数が増加の一途をたどっていた。また万一座繰りが深すぎた場合、元に復元することは不可能なためそのプリント基板を廃棄せざるを得ず、多層プリント基板の位置決めマークの座繰りはコストアップ、歩留り低下の主要因となっていて自動化が望まれていた。

【0006】

【課題を解決するための手段】本発明の座繰り装置は、対象物に座繰りを行うドリルと、このドリルを前記対象物の表面に対しほぼ垂直に移動させるZステージと、前記対象物の表面の前記ドリルの周囲に設けた吸引口部に吸引管により接続され座繰り時の切屑を吸引する集塵装置と、前記吸引管上に設置され高周波電流が供給される検出コイルと、この検出コイルが出力する電圧振幅が閾値を越え変化するのが設定回数に達するまで前記Zステージにより前記ドリルを前記試操物に向けて前進させる制御部とを含んで構成される。

【0007】本発明の座繰り装置は、対象物に座繰りを行うドリルと、このドリルを前記対象物の表面に対しほぼ垂直に移動させるZステージと、前記対象物の表面の前記ドリルの周囲に設けた吸引口部に吸引管により接続され座繰り時の切屑を吸引する集塵装置と、前記吸引口に設けられた発光素子および受光素子と、前記受光素子が受ける前記発光素子からの光が前記吸引口部に吸引される切屑の材質の相異により閾値を越えて変化するのが設定回数に達するまで前記Zステージにより前記ドリルを前記対象物に向けて前進させる制御部とを含んで構成される。

【0008】

【実施例】次に本発明について図面を参照して説明する。

【0009】図1は本発明の一実施例の座繰り装置の斜視図である。

【0010】図1に示す座繰り装置はドリル1と、ドリル1の回転を支持するスピンドル2と、ドリル1の回転を駆動するモータ3とを有するドリル機構系と、ドリル

機構系を搭載するステージ4と、座グリ時の切屑を吸引する集塵装置5と、ドリル1の周囲に設置される円周形の吸引口6と、集塵装置5と吸引口6とを結ぶ吸引管7と、吸引管7の円周上に吸引口5と隣接して設置される検出コイル8と、検出コイル8に出力する高周波発振回路9と、検出コイル8の出力がある閾値以下となる回数をカウントし、その回数あらかじめ設定された数値との比較を行い、その結果に応じた出力を行うコントローラ10と、コントローラ10の出力を入力しその値に応じてステージ4の駆動を行うドライバ11と、プリント基板13を固定するテーブル12とを含む。

【0011】モータ3により回転するドリル1は鉛直（Z）方向の位置制御をステージ4で行う。ドリル1がプリント基板13と接触を始めると切屑が飛び出てくる。この切屑はドリル1がプリント基板13をZ方向に進行するにつれ、絶縁部（ポリミド等）からのものと、銅箔部からのものとを層数分だけ繰り返していく。

【0012】切屑は集塵装置5の吸引口より吸引口6から吸引され、吸引管7を経て集塵装置5に集まる。吸引口6に隣接した吸引管7の一部の円周上にまかれた検出コイル8は高周波発振回路9から高周波電流を入力し高周波磁界を発生する。この高周波磁界中切屑が通過していく。絶縁部の切屑では検出コイル8の高周波振幅に変化は生じないが銅箔部の切屑は電磁誘導により銅箔切屑に誘導電流が流れるため検出コイル8の高周波振幅が減少する。図2に検出コイル8および吸引口6の断面図を示し、図3にドリル1がプリント基板13を座繰り進むときの検出コイル8の電圧振幅の一例を示す。

【0013】検出コイル8の電圧振幅をモニタすることにより切屑の材質の切り分けができる。このとき図3に破線で示す閾値を設定して、検出コイル8の電圧振幅がこれ以下となる回数、すなわち銅箔部をドリル1が通過した回数をカウントできる。コントローラ10にあらかじめ座繰りを行うべき層まで通過する銅箔部の数を入力し、前述のカウント値の差が零になるまでドライバ11に駆動信号を出力し、ステージ4を駆動してドリル1での座繰り深さを制御する。

【0014】図4は本発明の他の実施例の座繰り装置の斜視図、図6はプリント基板13上のドリル1の周囲に設置した吸引口部を示す断面図である。

【0015】図5に示す座繰り装置は、集塵装置5に接続された吸引管7の先端に設けられた吸引口部に吸引口の幅方向に光軸をもつように半導体レーザ14を設置し、半導体レーザ14に隣接して吸引口上に受光素子7を設置する。コントローラ17は受光素子7の出力がある閾値以上となる回数をカウントし、このカウント回数をあらかじめ設定された数値との比較を行い、その結果に応じた出力を行う。ドライバ11はコントローラ17

の出力を入力し、その値に応じてステージ4を駆動しドリル機構系を鉛直方向に移動させる。

【0016】モータ3により回転するドリル1をステージ4の駆動により下げて行きドリル1がプリント基板13と接触をはじめると生じるプリント基板13の切屑は集塵装置5により、プリント基板13上のドリル1の周囲に設置されるドーナツ型の吸引口部から集塵装置5に向け吸引される。この切屑に対し吸引口部に上下幅方向に光軸を持つ半導体レーザ14のレーザ光を照射する。レーザ光16の一部は吸引口部上の半導体レーザ14の反対面で乱反射する。残りのレーザ光は切屑に当たり散乱してその散乱光の一部は半導体レーザ14に隣接して設けた受光素子15に入射する。ここで切屑の材質の違いによるレーザ光の反射率の違いを利用して受光素子14の出力を見ていることによって切屑の材質の切り分けができる。具体的には絶縁部（ポリミド）の切屑による反射により受光素子14の受光量は銅箔部からのものに比べて約50％である。

【0017】図7にドリル1がプリント基板11を座繰り進むときの受光素子15への入射光量の変動を示す。図7に破線で示す閾値を設定して受光素子15の入射光量がこれ以上となる回数すなわち銅箔部をドリル1が通過した回数をカウントする。コントローラ17にあらかじめ座繰りしたい層までに通過する銅箔部の数を入力し、前述のカウント値との差が零になるまでドライバ11に駆動信号を出力しステージ4を駆動することによりドリル1の座繰り深さを制御できる。

【0018】

【発明の効果】以上説明したように本発明は、座繰り時に飛散するプリント基板等の対象物の切屑の材質の違いによる誘導電流の差または光の反射の差を利用して座繰り深さを制御しているため、基板のそり量等の対象物の変形に影響されずかつ対象物中の所定の材質の層まで正確に座繰り深さ制御を自動化でき加工工数を低減できるという効果がある。

【図面の簡単な説明】

【図1】本発明の一実施例の斜視図である。

【図2】図1中の検出コイル8の部分の詳細を示す断面図である。

【図3】図1中に示す実施例での座繰り深さ方向の位置と検出コイル8の出力との関係を示す図である。

【図4】（a）および（b）はそれぞれプリント基板の部分断面図および平面図である。

【図5】本発明の他の実施例の斜視図である。

【図6】図5中のプリント基板13のドリル1の周囲に設置した吸引口部を示す断面図である。

【図7】図5に示す断面図での座繰り深さ方向の位置と受光素子15の出力の関係を示す図である。

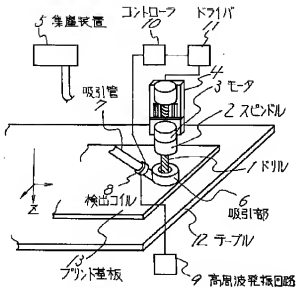
【符号の説明】

1 ドリル

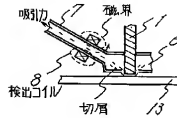
- 4 Zステージ
- 5 集塵装置
- 6 吸引口部
- 7 吸引管
- 8 検出コイル

- 13 プリント基板
- 14 半導体レーザー発振器
- 15 受光素子
- 20 銅箔部

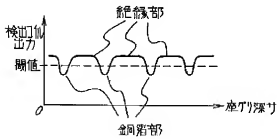
【図1】



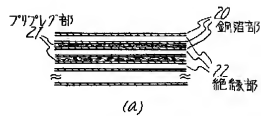
【図2】



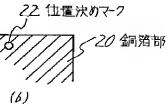
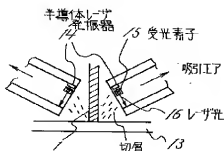
【図3】



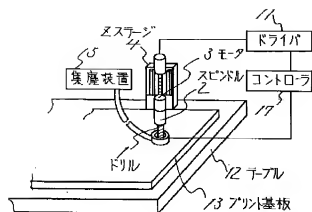
【図4】



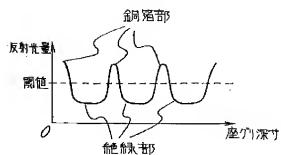
【図6】



【図5】



【図7】



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CLAIMS

[Claim(s)]

[Claim 1]Sedentary reeling ***** comprising:

A drill which carries out ***** to a subject.

A Z stage to which this drill is moved almost vertically to the surface of said subject.

A dust collection device which is connected to a suction opening part provided in the circumference of said drill of the surface of said subject by siphon, and attracts scraps at the time of *****.

A control section which turns said drill to said gymnastics thing by said Z stage, and is advanced until it reaches a predetermined number that a voltage swing which a sensing coil in which it is installed on said siphon and high frequency current is supplied, and this sensing coil output exceeds a threshold, and changes.

[Claim 2]Sedentary reeling ***** comprising:

A drill which carries out ***** to a subject.

A Z stage to which this drill is moved almost vertically to the surface of said subject.

A dust collection device which is connected to a suction opening part provided in the circumference of said drill of the surface of said subject by siphon, and attracts scraps at the time of *****.

A control section which turns said drill to said subject by said Z stage, and is advanced until it reaches a predetermined number that light from a light emitting device and a photo detector which were provided in said suction part, and said light emitting device which said photo detector receives changes with the difference of construction material of scraps attracted by said suction opening part exceeding a threshold.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates to the seat GURI device used especially for ***** of the positioning mark of a multilayer printed board about sedentary reeling ***** which carries out ***** to the subject in which different construction material was laminated.

[0002]

[Description of the Prior Art]The multilayer printed board needs to perform the electrical link of a signal plane and a voltage plane, and puncturing for component mounting. In the printed circuit board of the Kota layer and high density assembly in recent years, the circuit width of a signal plane is about 100 micrometers, and the puncturing to this printed circuit board needs to set that accuracy of position to about **30-50 micrometers. For this reason, when puncturing, to a puncturing device, a printed circuit board is positioned with high precision, and it fixes. As for this immobilization, it is common to drive in the pin for positioning beforehand on a printed circuit board, and to use this pin. This pin is driven in on the positioning mark on a printed circuit board.

[0003]Seat GURI is needed in order to recognize the positioning mark of the inner layer in the case of a multilayer printed board here. Drawing 4 (a) and (b) A multilayer printed board sectional view and a top view are shown in each. A printed circuit board is divided roughly, consists of the copper foil part 20, the prepreg part 21, and the insulating part 22 (polyimide), and has the positioning mark 22 in the copper foil part 20 of each class. In a multilayer printed board, seat GURI for a number of layers is performed to a layer with a positioning mark to recognize. However, about the layer which does not need highly precise puncturing, it excludes in many cases by a voltage plane etc.

[0004]On the other hand by the Kota layer printed circuit board, as for about 50-100 micrometers and copper foil thickness becoming very thin with about 18-35 micrometers, and neighboring thickness providing seat GURI in this each class further, among inner layers, the positioning accuracy of an about 10-micrometer seat GURI depth direction is needed. Although it is also possible to control in the positioning accuracy of a seat GURI depth direction by controlling positioning of the direction of seat GURI of a drill by a servo motor etc., since camber (hundreds of micrometers - several millimeters) has arisen in the printed circuit board itself, it is meaningless even if it makes accuracy of position of only a drill high. Then, conventionally, work including the skilled worker's visual inspection was performing ***** of the positioning mark of a multilayer printed board.

[0005]

[Problem(s) to be Solved by the Invention]Since a number also increased the more the more seat GURI of a printed circuit board becomes the Kota layer, the increase of a working man hour was being enhanced in the conventional help work. since it is impossible to restore to origin if seat GURI should be too deep — the print substrate — not discarding — it did not obtain, but ***** of the positioning mark of a multilayer printed board serves as a key factor of the cost hike and the yield

fall, and automation was expected it.

[0006]

[Means for Solving the Problem]A Z stage which a seat GURI device of this invention makes move almost vertically a drill which performs *****, and this drill to a subject to the surface of said subject, A dust collection device which is connected to a suction opening part provided in the circumference of said drill of the surface of said subject by siphon, and attracts scraps at the time of *****. It is constituted including a control section which turns said drill to said gymnastics thing by said Z stage, and is advanced until it reaches a predetermined number that a voltage swing which a sensing coil in which it is installed on said siphon and high frequency current is supplied, and this sensing coil output exceeds a threshold, and changes.

[0007]A Z stage which sedentary reeling ***** of this invention makes move almost vertically a drill which performs *****, and this drill to a subject to the surface of said subject, A dust collection device which is connected to a suction opening part provided in the circumference of said drill of the surface of said subject by siphon, and attracts scraps at the time of *****, A light emitting device and a photo detector which were provided in said suction part, It is constituted including a control section which turns said drill to said subject by said Z stage, and is advanced until it reaches a predetermined number that light from said light emitting device which said photo detector receives changes with the difference of construction material of scraps attracted by said suction opening part exceeding a threshold.

[0008]

[Example]Next, this invention is explained with reference to drawings.

[0009]Drawing 1 is a perspective view of the seat GURI device of one example of this invention.

[0010]The spindle 2 with which the seat GURI device shown in drawing 1 supports rotation of the drill 1 and the drill 1, The drilling mechanism system which has the motor 3 which drives rotation of the drill 1, and Z stage 4 which carries a drilling mechanism system, The dust collection device 5 which attracts the scraps at the time of seat GURI, and the suction opening part 6 of a circumference form installed in the circumference of the drill 1, The siphon 7 which connects the dust collection device 5 and the suction opening part 6, and the sensing coil 8 which adjoins the suction opening part 5 and is installed on the circumference of the siphon 7, The controller 10 which counts the number of times as for which the high frequency oscillation circuit 9 outputted to the sensing coil 8 and below a threshold with the output of the sensing coil 8 become, performs comparison with the numerical value to which the number of times was set beforehand, and performs the output according to the result, The driver 11 who inputs the output of the controller 10 and drives Z stage 4 according to the value, and the table 12 which fixes the printed circuit board 13 are included.

[0011]The drill 1 which rotates by the motor 3 performs position control of the direction of perpendicular (Z) by Z stage 4. If the drill 1 begins the printed circuit board 13 and contact, scraps will jump out. These scraps repeat the thing from insulating parts (polyimide etc.), and the thing from a copper foil part by the number of layers as the drill 1 runs the printed circuit board 13 to a Z direction.

[0012]Scraps are attracted from the suction opening part 6 with the suction force of the dust collection device 5, and gather for the dust collection device 5 through the siphon 7. The sensing coil 8 bound on a part of circumferences of the siphon 7 which adjoins the suction opening part 6 inputs the high frequency current from the high frequency dispatch circuit 9, and generates a high-frequency field. Scraps pass through the inside of this high-frequency field. In the scraps of an insulating part, although change is not produced in the high frequency amplitude of the sensing coil 8, since an induced current flows through the scraps of a copper foil part into copper foil scraps by electromagnetic induction, the high frequency amplitude of the sensing coil 8 decreases. The sensing coil 8 and the sectional view of the suction opening part 6 are shown in drawing 2, and the drill 1 shows drawing 3 an example of the voltage swing of the sensing coil 8 at the time of

sedentary reeling ***** for the printed circuit board 13.

[0013]It can perform that the construction material of scraps carves by monitoring the voltage swing of the sensing coil 8. The threshold shown in drawing 3 with a dashed line at this time is set up, and the number of times from which the voltage swing of the sensing coil 8 becomes less than this, i.e., the number of times to which the drill 1 passed the copper foil part, can be counted. The number of the copper foil parts which pass to the layer which should perform ***** beforehand is inputted into the controller 10, a driving signal is outputted to the driver 11 until the difference of the above-mentioned counted value becomes zero, Z stage 4 is driven, and sedentary reeling ***** in the drill 1 is controlled.

[0014]The perspective view of sedentary reeling ***** of the example of everything [drawing 5] but this invention and drawing 6 are the sectional views showing the suction opening part installed in the circumference of the drill 1 on the printed circuit board 13.

[0015]Sedentary reeling ***** shown in drawing 5 installs the semiconductor laser 14 so that it may have an optic axis crosswise [of a suction opening] at the suction opening part provided at the tip of the siphon 7 connected to the dust collection device 5, adjoins the semiconductor laser 14 and installs the photo detector 7 on a suction opening. The controller 17 counts the number of times which becomes beyond a threshold with the output of the photo detector 7, performs comparison with the numerical value beforehand set up in this counted number of times, and performs the output according to that result. The driver 11 inputs the output of the controller 17, drives Z stage 4 according to the value, and moves a drilling mechanism system in the perpendicular direction.

[0016]The scraps of the printed circuit board 13 which will be produced if it goes by lowering the drill 1 which rotates by the motor 3 by the drive of Z stage 4 and the drill 1 begins the printed circuit board 13 and contact with the dust collection device 5. It is drawn in towards the dust collection device 5 from the suction opening part of the doughnut shape installed in the circumference of the drill 1 on the printed circuit board 13. It irradiates with the laser beam of the semiconductor laser 14 which has an optic axis in the vertical width direction to these scraps at a suction opening part. Scattered reflection of a part of laser beam 16 is carried out in respect of [of the semiconductor laser 14 on a suction opening part] opposite. The remaining laser beams shine upon scraps, it is scattered about, and a part of the scattered light enters into the photo detector 15 which adjoined the semiconductor laser 14 and was provided. It can perform that the construction material of scraps carves by seeing the output of the photo detector 14 here using the difference in the reflectance of the laser beam by the difference in the construction material of scraps. Specifically, the light income of the photo detector 14 is about 50% compared with the thing from a copper foil part by reflection by the scraps of an insulating part (polyimide).

[0017]The drill 1 shows drawing 7 change of the incident light quantity to the photo detector 15 at the time of sedentary reeling ***** for the printed circuit board 11. The number of times to which the drill 1 passed, the number of times, i.e., the copper foil part, which set up the threshold shown in drawing 7 with a dashed line, and from which the incident light quantity of the photo detector 15 becomes more than this, is counted. The number of the copper foil parts which pass by sedentary reeling ***** beforehand is inputted into the controller 17, and the seat GURI depth of the drill 1 is controllable by outputting a driving signal to the driver 11 and driving Z stage 4 until a difference with the above-mentioned counted value becomes zero.

[0018]

[Effect of the Invention]Since this invention is controlling sedentary reeling ***** using the difference of the induced current by the difference in the construction material of the scraps of subjects, such as a printed circuit board which disperses at the time of ***** , or the difference of reflection of light as explained above, It is not influenced by modification of subjects, such as the amount of camber of a substrate, and sedentary reeling ***** control can be correctly automated to the layer of the predetermined construction material in a subject, and it is effective in the ability

to reduce a working manhour.

[Translation done.]

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1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.*** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a perspective view of one example of this invention.

[Drawing 2]It is a sectional view showing the details of the portion of the sensing coil 8 in drawing 1.

[Drawing 3]It is a figure showing the relation of the position of sedentary reeling ***** in an example and the output of the sensing coil 8 which are shown in drawing 1.

[Drawing 4](a) And (b) is the fragmentary sectional view and top view of a printed circuit board, respectively.

[Drawing 5]It is a perspective view of other examples of this invention.

[Drawing 6]It is a sectional view showing a part for the suction opening installed in the circumference of the drill 1 of the printed circuit board 13 in drawing 5.

[Drawing 7]It is a figure showing the relation between the position of sedentary reeling ***** in a sectional view, and the output of the photo detector 15 shown in drawing 5.

[Description of Notations]

1 Drill

4 Z stage

5 Dust collection device

6 Suction opening part

7 Siphon

8 Sensing coil

13 Printed circuit board

14 Semiconductor laser oscillator

15 Photo detector

20 Copper foil part

[Translation done.]